

S-69-38

October, 1969

5230

BIOLOGICAL EVALUATION OF SARATOGA
SPITTLEBUG ON THE NICOLET NATIONAL FOREST;
BASED ON 1969 SCAR-COUNT SURVEYS

By Imants Millers and Glen W. Erickson

ABSTRACT

Saratoga spittlebug scar-count surveys on the Nicolet National Forest reveal outbreak areas on the Eagle River and Florence Ranger Districts and one heavily damaged plantation on the Laona Ranger District. The Forest Manager is advised to consider chemical suppression of the spittlebug. Ultra-low volume application of Malathion LV at 10 fl. oz. per acre from air is the recommended control method. Supplemental scar-count surveys are recommended for plantations in the vicinity of the detected outbreak areas. Further survey needs are indicated for each plantation examined in 1969.

INTRODUCTION

The Saratoga spittlebug, Aphrophora saratogensis Fitch, is one of the major pests of young red pine plantations in the Lake States. The scars caused by adult feeding on pine branches are used to estimate the preceeding season's damage, and to estimate next year's spittlebug population. The scar-count surveys are made annually on selected susceptible red pine plantations. When an outbreak is detected, all the susceptible plantations in the vicinity of the outbreak are surveyed to determine if additional plantations are damaged. Then the Forest is advised to consider chemical suppression to prevent damage. Nymphal surveys in the spring are planned for the plantations proposed for control to confirm continuation of the outbreak.

BIOLOGICAL REVIEW

A. Causal Agent

The Saratoga spittlebug, Aphrophora saratogensis (Fitch)

B. Host

Red pine, Pinus resinosa Ait.

Alternate hosts are Comptonia sp., Rubus sp. and other woody shrubs. Other pines in the area may be attacked, but damage usually is not serious.

C. Type of Damage

The adult spittlebugs feed on 1-5 year old internodes of branches and the main stem. Necrotic areas, i.e. scars, are produced in the phloem, cambium and newly formed xylem as a result of the feeding. One season's accumulation of 35 or more scars per 4 linear inches of twig interferes with food and water translocation. At first, stunting of terminal growth occurs. Continued severe feeding in successive years results in branch and terminal die-back, i.e. flagging, and eventually, tree mortality. Thus, economic loss occurs from tree growth reduction, poor tree form and quality, and tree mortality (Ewan, 1961).

D. Ecological Considerations

The Saratoga spittlebug outbreaks are greatly affected by the tree host-alternate host ratio and climatic conditions (Ewan, 1961).

Spittlebug eggs overwinter under bud scales of red pine on the branches of the upper crown. The young nymphs, immediately after hatching from eggs in May, drop from the tree and migrate to herbaceous plants. When about 2 weeks old they move to woody shrubs, particularly sweet fern, Comptonia sp., and raspberries, Rubus sp. Indications are that local alternate host preferences do occur.

The spittlebug abundance is related to the host and alternate hosts available for oviposition, nymphal development and adult feeding. Generally, red pine plantations in the Lake States are susceptible to outbreak populations after the trees are 2 feet tall and until crown closure eliminates alternate hosts, i.e. tree height of about 14 feet with stocking at 1000 trees per acre. By causing tree stunting and mortality, unchecked spittlebug populations are able to maintain open red pine stands and thus prolong outbreak conditions. Other red pine pests, such as white grub, Scleroderma pine canker and defoliators may also produce conditions favorable to spittlebug outbreaks.

Weather is another ecological factor that can have adverse affects on spittlebug populations. Spittlebug nymphs are relatively protected at the root collar of the alternate host. However, late spring temperatures in low 20's may cause nymphal mortality. Also, the nymphs are readily susceptible to dessication during first migration from red pine to herbaceous plants and later to woody shrubs.

A few parasites and predators are reported for Saratoga spittlebug, but non effectively reduce outbreak populations.

SURVEY METHODS

Scar-count surveys are made to detect and evaluate Saratoga spittlebug outbreaks (Millers, 1968). Sample areas are selected systematically from a list of susceptible red pine plantations. An attempt is made to examine a plantation every 4 years, but more frequently when spittlebug build-up is detected.

All the scar-counts on the Nicolet National Forest were made by District personnel during the first 2 weeks in October--according to instructions provided by the staff of the St. Paul Field Office (see Appendix).

About 20 samples are taken from each plantation. Each sample is a count of scars on a 4 inch long twig taken from the penultimate internode of an upper crown branch.

The scar-counts determine the severity of damage and, indirectly, the spittlebug populations. The following classification is used:

Light	- less than 20 scars/twig
Moderate	- 20-35 scars/twig
Heavy	- more than 35 scars/twig

When heavy damage is found in a portion of a plantation, the entire plantation is classified as heavy.

When spittlebug outbreak centers are detected from the selected plantation samples, a supplemental scar-count survey is recommended to delineate the outbreak boundaries.

SURVEY RESULTS

The results of the scar-count survey are shown in Table I. The scar-count populations and the recommended action for each plantation is provided in the table. The Forest Manager is advised to consider the recommendations, and plan for future work.

Two major outbreak areas are apparent (Map 1). On the Eagle River Ranger District in T41N, R11E, four plantations are recommended for nymphal survey if suppression is warranted. Plantations in the adjoining Townships are recommended for supplemental scar-count surveys (Table II).

Similarly, on the Florence Ranger District, an outbreak is centered in T40N, R15E, and supplemental survey is recommended (Table II).

One plantation on the Laona Ranger District has high scar-counts and the Forest Manager is advised to consider its control.

TABLE I. RESULTS OF SARATOGA SPITTLEBUG SCAR-COUNT SURVEY - 1969 - NICOLET NATIONAL FOREST

Plantation Location				Area	Trees		Survey Results	
District Id. No. 1/	T	R	S	Acres	T/A	Ht./Ft.	Scars	Recommendations 2/
<u>Eagle River Ranger District</u>								
P-24b	40	11	15	12	530	5-12	L	Disc.-NM
P-49d	40	12	8	31	931	6	L	SC-'72
P-49e	40	12	15	41	700	----	-	Disc.-NM
P-50i	40	13	7	7	950	6	L	SC-'73
P-50j	40	13	21	7	1100	4	-	Disc.-NM
P-49m	41	11	13&14	12	1033	4	H	Nymph-'70
P-49c	41	11	23	10	1500	9	M	SC-'71
P-51a	41	11	25	26	1123	3.5	H	Nymph-'70
P-49a	41	11	27	49	960	5.5	H	Nymph-'70
P-51b	41	11	27	10	1350	4.5	H	Nymph-'70
<u>Florence Ranger District</u>								
136-16	38	14	26	6	1500	13	L	Disc.-NS
85-	38	15	9	2	1000	----	-	Disc.-NM
83-9	38	15	10	9	1333	10	L	Disc.-NM
83-31	38	15	13	35	993	----	-	Disc.-NM
69-27	39	15	34	30	800	----	-	Disc.-NM
116-3	40	14	22	20	1250	9.5	H	Nymph-'70
115-18	40	14	24	13	1000	10	M	SC-'71
18,36 - 21,26	40	15	16&17	30	1000	7	H	Nymph-'70
38-22	40	15	18	62	1300	8	H	Nymph-'70
38-23	40	15	21	15	1300	9	H	Nymph-'70
P-3b	40	16	12&13	15	1415	----	-	Disc.-NM
7-5	41	15	25	12	580	----	-	Disc.-NM
7-5	41	15	25	6	580	8	L	Disc.-NS
75-5,21	41	15	25	12	----	----	-	Disc.-NM
<u>Three Lakes Ranger District</u>								
123-5&7	39	12	3	11	100	7	L	SC-'73
127-1&18	39	12	18	28	70	4	L	SC-'73
91-10	39	12	19	26	----	10	L	SC-'73
<u>Laona Ranger District</u>								
148-3	34	14	1	7	1700	12	L	Disc.-NS
32-13	36	14	13	6	830	4	-	Disc.-NM
6-2	37	15	3&10	32	1300	3.5	M	SC-'71
4-5	37	15	15	32	1300	9	H	Nymph-'70
<u>Lakewood Ranger District</u>								
151-46	31	15	10	65	750	4	L	SC-'73
159-37	31	15	15	18	1000	6	L	SC-'73
173-44	31	15	25	27	1200	5.5	M	SC-'71
93-4	31	17	31	6	1200	10	L	SC-'73
93-6	31	17	32	6	1200	11	L	Disc.-NM
93-11	31	17	32	4	1200	11	L	Disc.-NS
64-21	32	16	33	12	1200	15+	-	Disc.-NS
64-18	32	16	33&34	15	1000	5.5	M	SC-'70
58-24	32	17	29	24	1200	9	L	SC-'72
69-13,21,31	32	17	34	12	1200	12.5	L	Disc.-NS
41-2	33	17	29	5	1200	12.5	L	Disc.-NS

1/ P-xxx = Plantation number
xxx-xx = Compartment number - stand number

2/ Nymphal = nymphal survey, if suppression is proposed; when no suppression, drop the plantation

SC + yr. = scar-count survey in year x

Disc. = Discontinue further surveys, because plantation is (NS) non-susceptible, or (NM) non-manageable

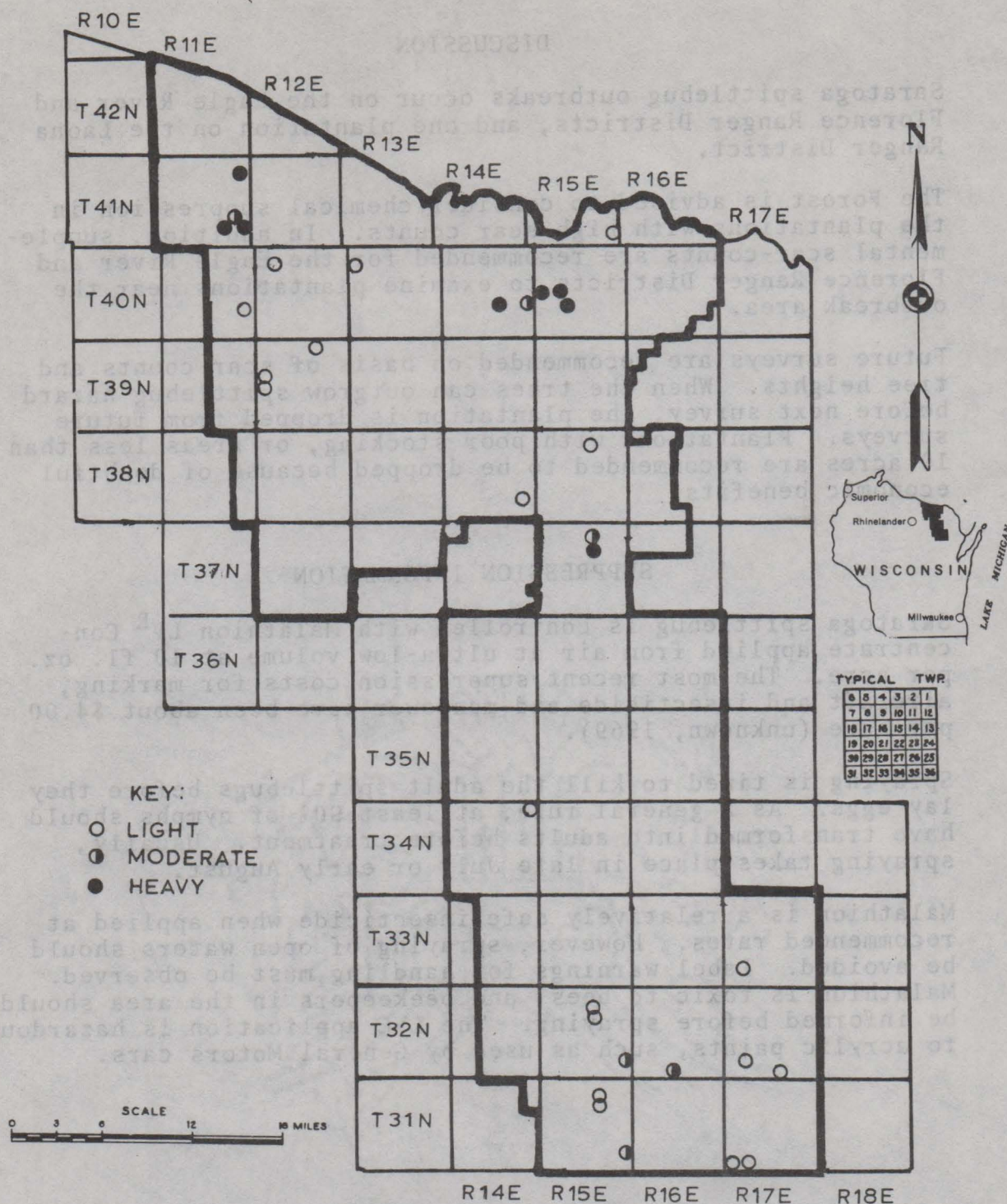
Table II. Areas recommended for supplemental scar-counts - 1969

Eagle River Ranger District

<u>Plant. No.</u>	<u>T</u>	<u>R</u>	<u>S</u>	<u>Acres</u>
52a	40	11	3	48
52e	40	11	10	30
---	40	11	15	90
31	40	11	15	12
24b	40	11	15	16
C-111	40	11	22	16
49c	40	11	23	10
53b	40	12	1	38
49h	40	12	2	44
49d	40	12	8	31
52f	40	12	10	60
53d	40	12	14,15	20
---	40	12	22	41
53j	41	11	13	8
49m	41	11	13,14	12
---	41	11	27	70
C-116	41	11	33	40
53g	41	12	15	12
53k	41	12	17	4
49f	41	12	33	8
---	42	11	18	10
Total				620

Florence Ranger District

<u>Plant. No.</u>	<u>T</u>	<u>R</u>	<u>S</u>	<u>Acres</u>
S-64t	39	14	15	---
7I	39	15	2	40
9I	39	15	25	20
7k	39	15	35	39
1f,2a	40	14	24	13
1b	40	15	13	25
1a	40	15	21	62
7j	40	15	29	13
7L	40	15/16	12/7	61
S-64v	40	15	29	---
9o	40	16	3	8
2g	40	16	6	39
3b	40	16	12,13	15
9p	40	16	14	14
2d	41	15	25	12
2e	41	16	28	12
7m	41	16	28	21
Total				394



Map 1. Saratoga spittlebug populations in red pine plantations on the Nicolet National Forest - 1969

DISCUSSION

Saratoga spittlebug outbreaks occur on the Eagle River and Florence Ranger Districts, and one plantation on the Laona Ranger District.

The Forest is advised to consider chemical suppression in the plantations with high scar counts. In addition, supplemental scar-counts are recommended for the Eagle River and Florence Ranger Districts to examine plantations near the outbreak area.

Future surveys are recommended on basis of scar-counts and tree heights. When the trees can outgrow spittlebug hazard before next survey, the plantation is dropped from future surveys. Plantations with poor stocking, or areas less than 10 acres are recommended to be dropped because of doubtful economic benefits.

SUPPRESSION INFORMATION

Saratoga spittlebug is controlled with Malathion LV^R Concentrate applied from air at ultra-low volume at 10 fl. oz. per acre. The most recent suppression costs for marking, aircraft and insecticide and manpower have been about \$4.00 per acre (unknown, 1969).

Spraying is timed to kill the adult spittlebugs before they lay eggs. As a general rule, at least 90% of nymphs should have transformed into adults before treatment. Usually, spraying takes place in late July or early August.

Malathion is a relatively safe insecticide when applied at recommended rates. However, spraying of open waters should be avoided. Label warnings for handling must be observed. Malathion is toxic to bees, and beekeepers in the area should be informed before spraying. The LVC application is hazardous to acrylic paints, such as used by General Motors cars.

R - Registered by American Cyanamid Company; contains 95% tech. malathion.

RECOMMENDATIONS

1. The Forest Manager is advised to consider chemical suppression for Saratoga spittlebug on Eagle River, Florence and Laona Ranger Districts.
2. Supplemental scar-count surveys are recommended for Eagle River and Florence Ranger Districts to delineate the entire spittlebug outbreak.
3. All the Districts have recommendations for future surveys of their plantations that were surveyed in 1969. The Forest Manager should act on the recommendations.

LITERATURE CITED

- Ewan, H. G. 1961. The Saratoga spittlebug. USDA, Forest Service, Tech. Bull. 1250. 52 pp.
- Millers, I. 1968. Biological Evaluation of Saratoga spittlebug as based on 1968 scar-count surveys on National Forests in the Lake States. USDA, Forest Service, State and Private Forestry, Northeast Area, St. Paul Field Office Report S-68-13. 18 pp.
- Unknown. 1969. Saratoga spittlebug control project - Huron-Manistee National Forests. (In-service report from Huron-Manistee National Forest. 6 pp.)

SARATOGA SPITTLEBUG SCAR-COUNT
SURVEY INSTRUCTIONS

By Imants Millers, Entomologist

INTRODUCTION

Scar-count surveys are made to detect Saratoga spittlebug outbreaks and to evaluate the severity of the outbreaks. Samples are selected systematically from a list of susceptible red pine plantations. An attempt is made to sample a plantation at least every 4 years, but more frequently after spittlebug build-up is detected.

METHODS

Plantation Selection - The sample plantations were selected by the St. Paul Field Office from an Atlas based on reforestation reports. However, it is the District Ranger's responsibility to confirm that each plantation is managed for red pine timber, before a Scar-Count survey is made.

Timing - Any time between October 1 and April 1. However, to allow time to submit control proposals the earliest possible date should be chosen and preferably the survey completed by October 15.

Office Preparation - Use Form SP-5230-2; one for each plantation.

1. Complete Section A from planting records. NOTE: When several plantations are intermixed, such as result from replanting, or after fires, the whole area that will eventually be considered a single stand should be called one plantation.
2. Plot the plantation on the map.
3. Determine the number of samples needed, and plot their approximate locations on the map (in pencil).

MINIMUM NUMBER OF SAMPLES PER PLANTATION

<u>Acres</u>	<u>Samples Needed</u>
10-20	10
21-80	20
81-160	30
160+	30 + 1 for each additional 10 acres.

The purpose is to get good coverage of the area and to do it economically. Usually, horseshoe shaped lines are used, and samples are taken at predetermined intervals.

Field Survey - Use Form SP-5230-2

1. Observe general plantation appearance. Do not survey when:

- a. trees are less than 2 ft. in height.
 - b. trees are more than 15 ft. in height.
 - c. No woody shrubs (sweetfern, blueberries, raspberries, willow, etc.) are present in the ground cover (mostly grass or no cover).
 - d. trees are under heavy shade; tree growth is stunted.
 - e. trees were sprayed for spittlebug or herbicided during the past growing season (1969).
2. Locate beginning of survey line and the first sample point.
 3. Select an average tree for the area (within a chain).
 - a. record the height of the tree (on left side of the Form).
 - b. Cut a branch from upper half of tree. Only the two-year old section (penultimate internode) is needed.
 - c. remove bark from mid-four inches (scraping with the back side of knife works best). Do not cut in the wood, nor leave any phloem.
 - d. mark off a 4 inch section and count the number of brown scars(spots). The number can be estimated to the nearest 10.

<u>No scars</u>	<u>Record</u>
0	0
1-5	1
6-15	10
16-25	20
26-35	30
36- +	+

- e. record the number of scars on the map at the approximate location of the sample.
4. Repeat step 3 at subsequent points until the survey is completed.
5. When the survey is done, complete section B&C on the Form SP-5230-2. Note, that the stocking and acreage is asked again. Any revised data should be shown here. Stocking can be expressed to the nearest 100 trees per acre.

Evaluation - The Field Forms are sent directly to:

U.S. Forest Service, FPC
 627 Federal Building
 316 Robert Street
 St. Paul, Minnesota 55101

The FPC staff evaluates the data and makes recommendations (section F) to:

1. Drop the area from further survey on the basis of decreased spittlebug hazards.

2. Resurvey at a given year.
3. To consider the area for suppression. In this case, other plantations in the vicinity also need surveys.
4. The Field Forms are returned to the District Ranger through the Forest Supervisor, who agrees or disagrees with the recommendation, and initials the Form (Section F). Further action means that the plantation is managed for red pine timber.

When suppression is needed, control proposals are initiated (FSM 5230 and 5240).

Reports - The FPC staff prepares a combined Biological Evaluation for all National Forests in the Lake States.

SP - 5230-2

SARATOGA SPITTLEBUG FIELD FORM

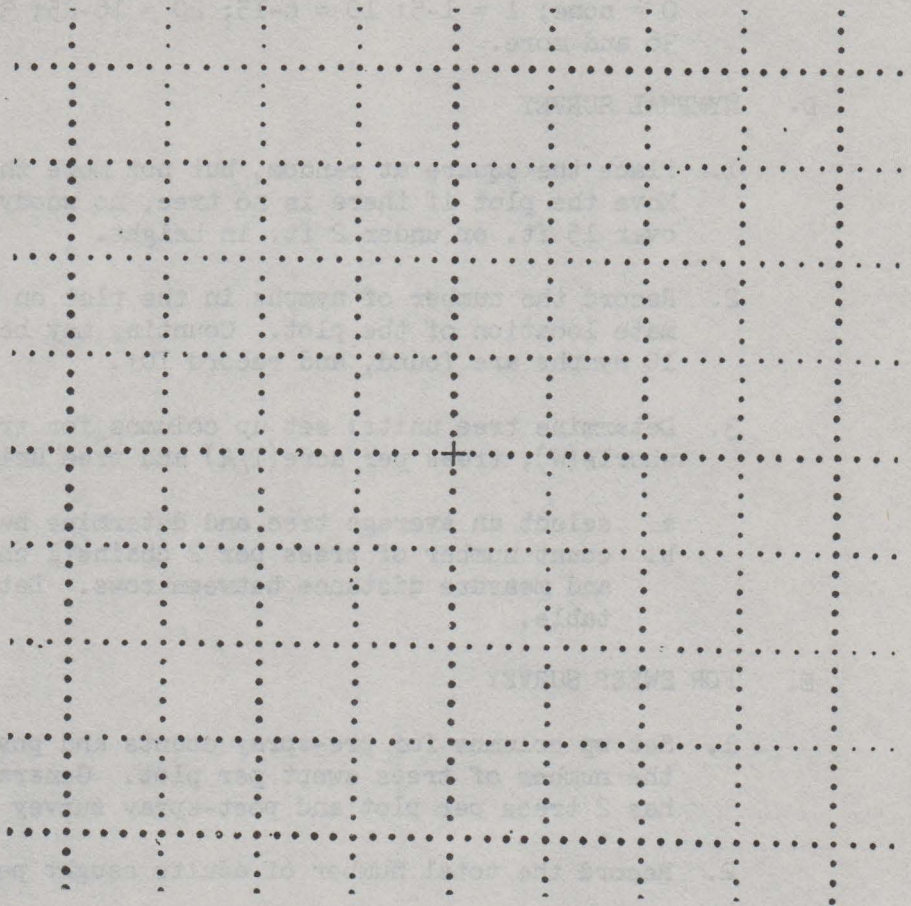
A. COMPLETE IN OFFICE: T ___ R ___ S ___ District ___ Forest ___

Comp. & Stand No. ___ Ir.Plant. ___ Stkng. ___ t/a Area ___ a.

B. COMPLETE AFTER SURVEY: Plant. Condition- good ___ fair ___ poor ___ (explain)

Avg.Tree Height ___ ft. Stocking ___ t/a Area ___ a. Date ___ Crew ___

C. TYPE OF SURVEY: ___ MAP SCALE ___ in./mi.



F. RECOMMENDATIONS:

1. District Ranger-

2. Entomologists-

SURVEY INSTRUCTIONS

- A. Complete the top line on the reverse side, draw a map, show survey lines and circle the type of survey. Write on the map how many plots are needed and the spacing of plots along survey line.
- B. After examining the plantation, describe the plantation; when poor condition is recorded, give reasons in space below
- C. FOR SCAR COUNT SURVEY:

- 1. Set up a column on the left side for tree heights. Record the height of each sample tree.
- 2. Record the number of scars per twig (4") on the map at the plot; 0 = none; 1 = 1-5; 10 = 6-15; 20 = 16-25; 30 = 26-35; 35+ = 36 and more.

D. NYMPHAL SURVEY

- 1. Place the square at random, but not more than 6 ft. from a tree. Move the plot if there is no tree, no woody shrubs, or trees over 15 ft. or under 2 ft. in height.
- 2. Record the number of nymphs in the plot on the map at the approximate location of the plot. Counting may be discontinued after 10 nymphs are found, and record 10+.
- 3. Determine tree units: set up columns for tree height (HT). live whorls(W), trees per acre(T/A) and tree units(U).
 - a. select an average tree and determine height and live whorls.
 - b. count number of trees per 2 chains(1 ch. up, 1 ch. back), and measure distance between rows. Determine stocking from a table.

E. FOR SWEEP SURVEY

- 1. Set up columns for pre-spray counts and post-spray counts. Show the number of trees swept per plot. Generally, pre-spray survey has 2 trees per plot and post-spray survey has 4 trees per plot.
- 2. Record the total number of adults caught per plot.

F. RECOMMENDATIONS

FPC and the Ranger records their recommendations after the survey. For example, drop from future survey, resurvey in '71, nymphal survey needed, etc.

G. SURVEILLANCE

Any unusual plantation conditions should be recorded, such as flagging, insect damage, mechanical damage, etc.